

GEAR AND BEHAVIOUR COMMITTEE

by A.R. Margetts

1970

Belgium

(P. Hovart)

For the beam trawl fishery a combined double beam trawl was designed with the main aim of increasing the catching capacity for pelagic fish during the shrimp fishery.

Two series of experiments with single boat pelagic trawls were carried out during the year. The nets which are intended as substitutes for the pair trawl were adapted for smaller vessels equipped for the beam trawl fishery. The first series of experiments took place in the Spring on board the fisheries research vessel "Hinders" and a commercial fishing vessel. The aim of these fishing experiments was to ascertain whether it was possible to fish with this net. During the Autumn, the second series of experiments was undertaken on board a commercial fishing vessel to examine the catching capacity of the net. The experiments were very satisfactory and steps are being taken to increase the catches still further by adjusting the rigging.

The theoretical study concerning a system of electrical impulses was continued with a view to substituting the tickler chains used during the fishing with bottom trawls. An apparatus for the electrical fishing on shrimps and flatfish was designed.

Theoretical studies concerning the influence of the temperature on the catch were also carried out.

Via log-sheets of fishermen a preliminary analysis of the effect of wind on catches was made for a vessel fishing in Icelandic waters during a five-year period.

The relationship between fishing power and certain fishing gear characteristics was studied. Within the scope of the ICES activities, calculations were made on the relationship between certain vessel characteristics (gross tonnage, engine power and length) and the fishing power. This study was carried out for Belgian beam vessels fishing for sole in a small part of Area IVc.

At the request of I.S.O. special attention was paid to preliminary methods and experiments in connection with the identification of netting yarns.

A newly designed safety system for beam trawl vessels was further tested.

Within the scope of the work-time studies in the fishing industry, a series of experiments with the rinsing and sorting machine for shrimps was also undertaken.

Canada

(J.M. Anderson)

Comparisons of catching efficiency of salmon drift nets of monofilament and multifilament twines, and comparisons of tag returns of salmon tagged from each type of gear, were continued in 1970. Catches per unit effort with the twine types were more variable than in 1969 experiments, and monofilament nets were more efficient only at the largest mesh sizes used (152 mm stretched). Fish taken in these large monofilament meshes appear to be more viable, and have yielded a higher proportion of returns in several tagging experiments than fish tagged from multifilament nets.

A hydraulic flume was designed for the study of the behaviour of marine animals, and of underwater instruments, in moving water under controlled laboratory conditions.

Three different towed underwater vehicles, two unmanned, the other accommodating two SCUBA divers, were designed and built. All are fitted with cameras and strobes. Their main purpose is for observing the sea floor in benthic survey operations.

The engineering study of otter trawls, aimed at the development of verified engineering principles for the rational design of new trawls, has now reached the stage where experimental data obtained over the past few years from operations at sea, have been given sufficient computer treatment so that most hypotheses concerning the distribution of stresses in, and the shape of, the working gear can now be checked.

The Canadian submersible, PISCES I, was used in a successful survey of spawning behaviour of herring on Georges Bank on the western Atlantic continental shelf off the Gulf of Maine.

In the continuing acoustic studies in cod, with special emphasis on the reaction of fish to gear noise, a new hydrophone system has been designed to record ambient noise continuously over a wide noise range spectrum, from very low to high sea states. Experiments continue on the investigation of whether or not, in cod, the acoustic stimulus is pressure or displacement, or both.

Lobster urine contains a pheromone which is attractive to both males and females, but the greatest degree of attraction is of mature males to the urine from recently moulted female lobsters. Work continues on the identification of the chemo-receptors which mediate the behavioural responses to the above pheromone and to food odours in lobsters.

A method was developed for making electrical recordings from the olfactory mucosa of Atlantic salmon. This is related to a programme investigating the physiological basis for the migratory behaviour of salmon.

Work continued on the use of ultrasonic telemetry as a method of following the movements of fish at sea under natural conditions.

Denmark

(K. Popp Madsen)

Observations on selectivity and relative efficiency of monofilament (Polyamide) and multifilament (Polyester) salmon drift nets were carried out from commercial vessels at West Greenland.

France

(M. Portier)

La majorité des bateaux de 150 à 400 CV qui pêchent dans le sud de la Mer du Nord et en Manche travaillent avec des chaluts de fond à grande ouverture verticale. On a donc étudié pour les bateaux de 1200 à 2000 CV un chalut de ce type - le modèle a été mis au point en bassin et les essais effectués à la mer. Suivant le type de gréement employé on a obtenu des ouvertures allant de 5.50 m à 8.00 m.

En même temps ont été essayés de nouveaux panneaux divergents ovales au profil creux qui ont montré, sur le fond, une divergence améliorée de 15 à 20% par rapport aux panneaux ovales plans de même côtes extérieures. Ces panneaux peuvent également être utilisés en chalutage pélagique et présentent une bonne stabilité entre deux eaux.

Les chaluts pélagiques à deux bateaux qui ont été utilisés pour la pêche du hareng dans le sud de la Mer du Nord, au cours de la campagne 1970, ont tous des grandes mailles à l'entête (600 mm) et des essais ont été effectués avec des mailles de 800 mm.

Pratiquement tous les chaluts sont faits en polyamide, seuls quelques chaluts de fond utilisés sur des terrains très durs en Manche sont en polyéthylène.

Enfin, il est à signaler que le rendement du chalut sélectif à crevettes a été amélioré par son inventeur qui a trouvé un artifice permettant à la nappe intermédiaire de bien fonctionner en toutes circonstances.

Germany

(H. Bohl)

Fishing Gear and Apparatus : In the year under consideration gear investigations were concentrated on high-opening bottom trawls. Different possibilities of constructing this gear have been compared experimentally. The influence of the towing speed on the vertical and horizontal net opening was investigated.

The development of various types of a thermosonde which are used in conjunction with the netsonde, has reached such a stage that it has been adopted by the commercial deep-sea fisheries. By means of this equipment the searching time can be reduced.

After a period of stagnation, experiments with electrified trawls used for deep-sea fishing were continued.

Selectivity Experiments : Rather extensive studies on the selectivity of bottom trawls were carried out on board the R.V. "Walther Herwig" in April 1970. A cod-end made of the new standard polyamide netting yarn (R 6484 tex) was compared with a cod-end made of an extra strong polyamide netting yarn (R 18000tex). The selection factors obtained for cod were 3.41 for the standard yarn and 3.51 for the thick yarn. Since these results conform with those from experiments carried out with the same cod-ends in 1969, there is now every appearance that, as far as the escapement of small fish is concerned, very strong cod-ends can be used to obviate the need for topside chafers.

Also in April 1970, and at the same place and on the same stock, a series of hauls was made with two polyamide cod-ends which differed from each other in the elongation properties but not in the fibre of their netting yarns. The selection factor for a netting yarn with an elongation of 38.8% at half the knot breaking load was 3.49, whilst that for a netting yarn with an elongation of 21.5% was 3.15. These findings appear to show that high elongation is associated with high selection factors. However, taking into account that both the cod-ends mentioned in the first paragraph of this section were made of netting yarns with low elongations (23.8 and 21.0%), it becomes obvious that there was no clear relationship between elongation and selectivity. Finally, it has to be mentioned that an analysis of individual hauls did not reveal any negative correlation between catch size and selection factor.

Net Materials : As in previous years, almost entirely polyamide netting yarns were used for the manufacture of trawls. Plaited polyethylene yarns were used only exceptionally.

The commercial use of extra strong polyamide netting yarns changed from about R 18000 tex (diameter 7 mm) to about R 14500 tex (diameter 6 mm). The reasons for this were lower costs, easier manufacture and higher resistance of the knots against abrasion.

The cooperation with national and international bodies concerned with standardization of net materials was continued. Activity was concentrated on shaping of netting and testing methods for net materials.

Fish Behaviour : The experiments concerning the technology of high-opening bottom trawls were combined with studies of fish behaviour. The conditions for observation by means of underwater camera and echosounding equipments proved unfavourable, because during the late summer in the working area off the U.S. east coast bottom fish formed no schools but were widely scattered. In the course of the experiments many hauls were made between identical positions of shooting and hauling. Because the influence of different environmental conditions was thus considerably reduced, compositions gave clues as to the changes in the behaviour of fishes. Marked differences in the catch compositions were observed, dependent on the rigging of gear used and on the daytime. The most striking change was found in the behaviour of skates and rays which during daytime were not caught at all or were represented in the catch by only a few small specimens; at dusk their numbers increased, and at midnight the major part of the catch often consisted of skates and rays of all sizes.

Studies on noises caused by fishing vessels and trawls in action were continued by means of a newly constructed hydrophone. The main energy content of noises produced by a 200-foot-bottom trawl fitted with bobbins and towed at a speed of 3.8 kn was found to be in the frequency range from 6 to 10 cps.

Iceland

(G. Thorsteinsson)

Bottom Trawling: Continued efforts were made to discover new prawn fishing grounds off the north and SW-coasts of Iceland. Off the north coast in deep waters catches up to a maximum of 200 - 300 kg deep sea prawn (Pandalus borealis) per trawling hour were obtained in a selective trawl of French type and in a 130' prawn trawl of Icelandic design. The attempt to catch Nephrops norvegicus in the lower cod-end of a selective trawl and Pandalus borealis in the upper one did not succeed as hardly any prawn could be found on the Nephrops fishing grounds during the experimental time. Another attempt will be undertaken in 1971.

An attempt to avoid young haddock and cod from being caught in prawn trawls on the conventional prawn grounds off the NW-coast did not prove very successful. The experimental gear was a kind of a selective trawl, similar in design to a USA trawl. This experiment will be continued in 1971 in juveniles of commercially important fish species which are observed in serious quantities in the prawn catches.

Mid-water Trawling: Some attempts have been undertaken in catching blue whiting off the Icelandic east coast in a large mid-water trawl of German type. The results have been poor due to very scattered occurrence of this species. Good capelin catches have been made with a capelin mid-water trawl of Norwegian type; but purse-seines seem to be much more effective in this fishery.

Material Testing : Some material testing has been carried out for various parties.

Material in Use : Bottom trawls and Danish seines-polyethylene only. Purse-seines-polyamide only. Gillnets-polyamide only (mainly multi-filament). Longline-mixed line of polyethylene and polyester.

Ireland

(A.E.J. Went)

Work within the purview of the Committee carried out during 1970 was restricted to one species, Nephrops. Mesh selection was studied by measuring the mesh of the cod-end, body and wings in trawls from which commercial samples were obtained and by using small meshed covers on the cod-end and wings of the trawl used in research vessel surveys.

The behaviour of Nephrops was also studied by making repeated short hauls on adjoining parallel tracks at dawn and dusk and correlating variations of the catch with the prevailing degree of illumination.

Italy

(F. Matta)

No gear and behaviour work undertaken.

Netherlands

(J.G. de Wit)

Research to improve the catching ability of beam trawls for shrimps by means of electric ticklers continued. Parallel to this, work on the development of electric ticklers for the sole-fishery has been carried on. New electronic equipment based on earlier findings is under construction. This new equipment will be used on board research vessels as well as commercial vessels.

Work on the rotating shrimp sieve continued. Sorting out marketable shrimps from often big quantities of undersized shrimps and by-catch was further improved. The chance of survival of the undersized shrimps and by-catch (mainly undersized flatfishes) has been increased. The working speed (capacity) of the machine has been improved. It is being introduced into the commercial fishing fleet rapidly.

Measuring the towing resistance of mid-water trawls was continued and preliminary results were used to study the power division of main engine and winch drive of new trawlers. The introduction of bigger meshes in the front part of mid-water trawls resulted in a lower towing resistance at the fishing speed. The result of this was that fishing vessels with about 1000 BHP can now tow a mid-water trawl of a reasonable gape and that the net-size of mid-water trawls further increased. Mesh sizes of about 100 cm and more in the front part of the net are under construction now.

The same trend can be observed for pair trawls. Both mid-water trawls and pair trawls with big meshes in the front part of the nets are a danger for the crew when standing on the webbing of a net ready to be shot and offer difficulties in hauling the nets by hand. This trend, therefore, led to a rapid introduction of net drums. Such drums also reduce the hauling time and extend the real fishing time per hour at sea.

Experiments with an improved herring bottom trawl showed that the vertical opening of this type of net could be improved from 2.50 to 6.50 m.

Studies started to improve the fishing effort measurements of the beam trawl for flatfish. By using pull in the warps (which is closely related to propeller thrust) instead of horse power according to the fleet register, the correlation could be considerably improved. These studies are still under progress.

Equipment to register and collect operational data of fishing vessels under fishing conditions has been developed.

Work on standardization of fishing nets continued in co-operation with ISO.

Yarns for net-making were 100% polyamide.

Norway

(O. Nakken)

Gear

The R/V "G.O. Sars" made her first regular cruise in May. She carries four different types of trawl, each of which can be operated with only a minor loss of time. Three of the trawls including the large pelagic trawl are carried on rollers, and therefore the heavy weights on this trawl were replaced by chains of lead attached to the bridles.

Due to the relatively large catches of young fish in shrimp trawls - especially in northern waters - investigations were started on different types of trawls to evaluate methods to separate fish and shrimps. The results were promising and the investigations continue.

Net materials of polyamide dominate in the Norwegian fisheries.

Behaviour

Studies on hearing direction of fish and their reaction to noise continued at a field station. These studies were completed in the summer of 1970 and the material is now being analysed.

A working group started a study on guiding of fish by sound.

Acoustics

Work on improvement of acoustic methods for abundance estimation was continued. Studies on the possibility for acoustic identification were carried on.

Poland

(W. Strzyzewski)

In 1970 Poland carried out the following investigations in the field of fishing technique :

1. The behaviour of the Baltic cod and herring within the zone of trawl opening and inside the trawl. This investigation was designed to establish through which part of the trawl opening the fish first enter and what was their behaviour inside the trawl.
2. The behaviour of fish in an electrical field at the trawl.
3. Model tests for both bottom trawls and trawls operated above sea bed and designing of trawls based on model tests for new types of fishing vessels.
4. Some initial observations on strengthened steelon fibre (Polyamide)

The material used in Polish fisheries is the same as in the previous years - polyamide.

Portugal

Spain

(O. Cendrero)

On a fait, dans l'étude générale de pêches pour la Galice, des expériences de sélectivité de chaluts à polyéthylène, polypropylène et polyamide sur le plateau de la côte du nord-ouest de l'Espagne.

Sweden

(G. Otterlind)

From 1970, no special activity is to be reported.

No remarkable changes have occurred in the use of net material since the report for 1967. In bottom trawls, terylene, (Polyester) is predominating, often combined with nylon (Polyamide) in the cod-end (sometimes nylon in the whole posterior part of the fish trawl).

Pelagic trawls are made exclusively of nylon. In the cod-end of fish trawls plaited nylon (dia. ca. 3 mm) is most commonly used.

United Kingdom

1. England

(A.R.Margetts)

The A.R.L. sector-scanning sonar was used to study bottom trawls, a pelagic single-boat trawl and a purse-seine in action. Details of the gears were observed and the fishing dimensions of the trawl measured. Fish were seen in the vicinity of trawls and their reactions noted; sandeels were seen being taken by a bottom trawl and unidentified species (probably sprats) were seen to avoid the headline of a pelagic trawl in shallow clear water in daylight by rising above it. The changing shape of a purse-seine during "drying-up" was followed and herring were seen within the pursed net.

Using the 16 m coastal fishing craft "Tellina", observations were made of the effect of a trawl and its tickler chain on the sea-bed. On a particular type of ground, some stones were dislodged out of the bottom to lie fully exposed, this was done by the chain legs, groundrope chain and tickler chain.

The sizes, shapes and packing densities of shoals were studied with the sector-scanning sonar and first results suggest that eventually estimation of numbers of fish in a shoal should be possible.

The behaviour of sandeels was also studied by sector-scanning sonar and results indicate that the controlling factors for the emergence of the fish from the sea bed are an association of light and food.

The sector-scanning sonar was also used to study fish movements, avoidance reactions and reactions to environmental conditions, e.g. water currents. Plaice tagged with the transponding acoustic tag (dimensions 4.7 x 0.8 cm) have been tracked by sector-scanner for up to 25 hours; for considerable periods of this time the fish were off the bottom.

Using commercial trawler fishing records, a study was made of variation of catch per effort with environmental factors such as wind. A computer programme was used in the analysis.

Cooperation with British Standards Institute and International Standards Organisation on fishing gear subjects was maintained.

The net material most used in English bottom trawl fisheries was polyethylene. Polypropylene was used on a small scale. Some bottom trawl cod-ends were made of polyamide and a few of polyester and polypropylene. Pelagic trawls were mostly of polyamide.

2. Scotland

(B.B. Parrish)

The programme of research with a large demersal trawl referred to previously was continued during the year. The engineering aspects of various rigs producing different net and board spreads were studied using the computer-based data logging equipment on FRS "Explorer". Catch sizes and compositions obtained during comparative fishing experiments have also been analysed.

As part of the overall study of fish capture, two major programmes of research were begun during the year. One of these is concerned with the direct measurement of noise generated by bottom and midwater trawls, the other is designed to evaluate the effect on fish of different electric fields. These projects will be studied in the Marine Laboratory's Fish Behaviour Unit, in a sea loch on the west coast of Scotland and in the open sea.

Related to this work have been investigations of the reception threshold of gadoids. Work has also been carried out in oceanic type water on underwater visibility as part of a programme to develop an underwater visibility meter for use in predicting the visible range of different parts of fishing gear.

Work also continued on the development of photographic recording techniques for use in field and laboratory studies of fish behaviour. These included the development of stereo-photography for obtaining three-dimensional information about fish behaviour in the neighbourhood of fishing gear.

Further comparisons were made between the selectivity of seine-net cod-ends used with and without outer strengthening covers of large mesh size. These indicated that whilst a lowering of selectivity could result from the use of such covers this was by no means always true.

The development of acoustic fish counting techniques has continued both at the original frequency of 400 kHz and also at 38 and 50 kHz. Equipment for this work has been designed to interface the Simrad Scientific Sounder to the pulse height analyser.

Studies have been made of the vertical attenuation coefficient of ultra-sound in sea water and these will be extended to study the effects of seasonal variation in plankton abundance.

Time-lapse camera techniques have been applied to study the behaviour of Nephrops norvegicus and also to record water movement using dye trails. Underwater television equipment has also been used for studies of benthos and fish behaviour.

U.S.S.R.

(A. Treschev)

In 1970 theoretical investigations of techniques in commercial fishery investigations were continued with the aim of choosing the most efficient forms of cutting out trawl nets, in connection both with the selectivity and with the most economical expenditure of net materials. Based on the results of the investigations, a new construction of bottom trawl has been designed.

Work has been done on the development of otterboards.

In July-August 1970, 35 submersions were made in the observation chamber "Sever-I" from the RV "Tunets" in the Barents Sea aiming at investigations of fish behaviour under natural conditions. Cod and capelin were the subjects of observations. It has been found that cod avoid turbid water. The general character of daily vertical migrations of capelin and some features of its behaviour at different hours of the day were obtained. Density of capelin concentrations was determined.

Under water and above water sources of light were used for observation on reactions of polar cod to light.

In 1971 research work is intended to be carried out on all the above mentioned problems and especially studies on behaviour of fish in the zone of the trawl operation will be continued.

All trawls used in fisheries in 1970 were made of kapron (Polyamide) twine.